

## **TITLE: DYNAMIC CERVICAL PLATE**

## BACKGROUND OF THE INVENTION

## Field of the invention

This invention relates to the field of orthopedic surgery and, particularly, to the area of spinal implants for stabilizing the spatial relationship of vertebrae. The device is designed for use in the cervical region of the spine though one skilled in the art may use the device in other regions of the spine and other skeletal fixations.

## Description of the Prior Art

Spinal plates are well known in the orthopedic art for fixing bones or bone fragments in a pre-selected spatial orientation. The plates are usually attached to the bones or bone fragments by screws designed to make a secure and long lasting connection not affected by the loads caused by normal activities of the host. Gertzbein et al, U. S. Patent No. 5,620,443, teaches an adjustable cervical connector composed of dual rods spanning the distance between adjacent vertebrae. The rods carry at least two slidable transverse connectors which are attached to the vertebrae by spikes and pedicle screws thereby fixing the relationship of the bones. The connectors are immobilized on the rods by clamps.

Richelsoph, U. S. Patent No. 6,017,345, teaches a spinal plate spanning the distance between adjacent vertebrae. The plate has screw holes in each end. The pedicle screws are inserted through the holes and allow for some movement.

Shih et al, U. S. Patent No. 6,136,002, teaches a similar device to that of Gertzbein with the

1       clamps screwed onto the elongated rods.

2       Published Patent Application US 2003/0060828 A1 to Michelson teaches a cervical plate with  
3       at least two plate elements slidably connected together and fixed by a set screw. The contacting  
4       surfaces of the plate elements are formed with ratcheting to provide added security.

5       In all these prior art devices, the plate must be held in the selected position while the securing  
6       set screws or other fasteners are put in place and the final assembly is completed.

7       What is needed in the art is a dynamic cervical plate that may be adjusted to length, locked in  
8       place to provide compression, and will automatically shorten its length to maintain compression.

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## 10      **SUMMARY OF THE PRESENT INVENTION**

11       Therefore, it is an objective of this invention to provide a cervical plate with an elongated  
12       shaft adapted to span the intervertebral space and having at least two screw receivers spaced  
13       along the length of the plate. The screw receivers each have screw holes for accepting the heads  
14       of pedicle screws.

15       Another objective of this invention is to provide a locking mechanism that is manually  
16       operated simultaneously with the positioning of the screw receivers along the plate to provide  
17       compression across the intervertebral space.

18       A further objective of this invention is to provide the locking mechanism with a retainer  
19       extending over the screw holes to prevent back out of the screws.

20       Yet another objective of this invention is to provide a guide rail on the plate shaft cooperating

1 with the screw receivers to permit sliding connection between the screw receivers and the plate  
2 shaft.

3 Still another objective of this invention is to provide a ratchet mechanism on the shaft and  
4 screw receivers to permit post operative one-way movement shortening the distance between the  
5 screw receivers and maintaining compression across the intervertebral space.

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7 **SHORT DESCRIPTION OF THE DRAWINGS**

8 Fig1 is a perspective of the cervical plate and screw receivers of this invention;

9 Fig. 2 is a bottom plan view of the cervical plate and screw receivers;

10 Fig. 3 is a cross section of the cervical plate, along line 3-3 of Fig. 1, with the clip unseated;  
11 and

12 Fig. 4 is a cross section of the cervical plate, along line 4-4 of Fig. 1, with the clip seated in  
13 the ratchet.

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15 **DETAILED DESCRIPTION OF THE INVENTION**

16 The cervical plate 10 has an elongated flat shaft that is made in different lengths but must be  
17 of a length to span, at least, the distance between two vertebrae. The plate has a lateral bar 12  
18 fixed to one end and a free end. The bar has an countersunk apertures 20, 20' on each side of the  
19 plate for capturing the head of pedicle screws. Permanently mounted to the plate is a clip having  
20 ears 18, 18'. The clip is resilient and extends under the plate parallel but outside the periphery of

1 the bar then rises vertically to the top of the plate and extends across the pedicle screw apertures  
2 20, 20'. The portion that extends across the countersunk apertures 20, 20' are the ears 18, 18' for  
3 retaining the pedicle screws to prevent back-out. The retainer is resilient enough to allow flexing  
4 while the heads of the pedicle screws are seated in the aperture then is released on top of the  
5 screw heads. In one embodiment, the ears 18, 18' have wedges 50 which engage the edges of the  
6 screw heads as the screws are tightened to further lock the screws in place.

7 The bottom of the shaft has a row of teeth 15 formed across the longitudinal axis of the plate.  
8 The teeth are angled to form a ratchet allowing one-way movement of a bar from the free end  
9 toward the lateral bar at one end of the plate. In some instances, the teeth may be cut normal to  
10 the shaft. Along each longitudinal side of the shaft is a groove 23, 23' extending from the free  
11 end toward the lateral bar.

12 Slidably attached to the free end of the shaft is at least one movable bar 13 but two are  
13 preferred. The second bar 14 is of the same construction as the bar 13. Bar 13 and bar 14 have  
14 the same structure therefore, reference to elements of one bar is the same as the other.

15 The slidable bar 13 has a distal surface which engages the vertebrae and is convexly curved to  
16 closely fit the curvature of the vertebrae. The bar has an aperture 21, 21' near each end with a  
17 depression 25 therebetween. The depression is approximately the same depth as the thickness of  
18 the shaft to provide a low profile to the assembled cervical plate. The opposite edges of the  
19 depression have shoulders 26, 26', shown in Fig. 3, that slide within the longitudinal groove 23,  
20 23' in the plate. This provides a close association between the surface of the bar depression and  
21 the ratchet teeth of the plate.

Attached to bar 13 is a clip having a retainer 17, 17'. The clip has an elongated hollow body with an oval shape. The sides of the oval follow the edges of the depression so that the retainers 17, 17' are on the proximal surface of the bar. At least one side of the clips is welded 99 or otherwise permanently attached to the respective side of the bars. The rounded ends of the oval form the screw retainers. The pawl portion 27, 28 of the clips extend across the shaft engaging the teeth 15 to form the ratchet. The pawls are formed by a raised flange 24, shown in Fig.3.

In the preferred embodiment, the clips 16 and 17 have a flange that extends above the surfaces of the bars to engage the teeth 15 of the ratchet on the shaft. Of course, the clips may have pawls 27, 27' and 28, 28' on both sides of the bar, shown in Fig. 2. By flexing the clip with an instrument, the flange 24 can be disengaged from the ratchet teeth 15, as shown in Fig. 3, for initial adjustment.

In operation, the vertebrae are manipulated into the desired position and grafting material placed as required to compensate for removal of bone and/or disk material. The plate is placed on the spine and adjusted to provide some compression on the site to assist in the grafting of the spine. As the bars are slid along the shaft, the shoulders of the bars and the grooves on the shaft maintain a close fit between the pawls and the teeth on the shaft requiring the pawls to be deflected by the teeth. Once the bars are in the desired location and the flanges seated in the teeth, the ratchet prevents retrograde movement of the bars away from the head. The pedicle screws are driven into the spine. As the screw heads engage the apertures the retainers are flexed to permit the screw heads to seat in the apertures and released to block back-out.

It is well known that as the site heals and the adjacent vertebrae begin to graft together and as

1 a result of the forces of gravity, there is some reduction in the span between the vertebrae. As  
2 this occurs the dynamic cervical plate can accommodate the reduction and maintain some  
3 compression because the shaft will move in the bars resulting in the clips moving from one  
4 ratchet tooth to the next automatically shortening the intervertebral distance.

5 The second bar may be added to the free end of the plate to add stability to the compressed  
6 site and to reduce and equalize the pressure. Of course, the pawls may be omitted, and the plate  
7 may move in both directions within the bars.

8 A number of embodiments of the present invention have been described. Nevertheless, it will  
9 be understood that various modifications may be made without departing from the spirit and  
10 scope of the invention. Accordingly, it is to be understood that the invention is not to be limited  
11 by the specific illustrated embodiment but only by the scope of the appended claims.

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